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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Applicant : Richard S. Greenberg
Serial No. : 10/791,521
Filed : March 2, 2004
For : SOIL AND/OR GROUNDWATER
REMEDIAL PROCESS
Examiner : James Fiorito
Art Unit : 1754
Confirmation No. : 2769
Attorney Docket No. : 130.1.005 C-2

I HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO: MAIL STOP AF, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VIRGINIA 22313-1450
ON May 11, 2007
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May 11, 2007

RESPONSE TO FINAL OFFICE ACTION

Dear Sir:

This is in response to the final Office Action of February 22, 2007. All of the claims (claims 1-5, 8-16 and 18-21) stand rejected as obvious over the combination of the Nelson and Brown Publication in view of Elgal (U.S. Patent No. 5, 663,475)

and Feasey (U.S. Patent No. 5,130,053). The Office Action states that Nelson clearly teaches in situ ozonation with hydrogen peroxide and administering hydrogen peroxide before administering the ozone would not yield unexpected results. The rejection is hereby traversed and reconsideration is respectfully requested.

The present invention is directed to an in situ method for treating contaminants in which the environment is provided with a stabilized source of peroxide. Thereafter, ozone is administered in an "effective amount". The combination of administering the peroxide first followed by an "effective amount" of ozone results in the formulation of a reactive species (e.g. hydroxyl radical) without problems that have been associated with the use of peroxide and ozone in prior art treatments. In particular, the method is conducted without aggressive reactions between the stabilized source of peroxide and the ozone at the point of administration and without acidification of the environment.

The present invention is an improvement over the use of classic in situ Fenton's systems which employ hydrogen peroxide and some form of a catalyst such as a metal catalyst. As indicated on page 4 of the present application, the Fenton's systems are often limited by instability of the hydrogen peroxide in situ and the lack of spatial and temporal control in the formation of the desired oxidizing agent (hydroxyl radical). The aggressive/violent reactions often occurred at or near the point where the source of the oxidizing agent (hydrogen peroxide) and the catalyst were injected. As a consequence, a significant amount of reagents including the

hydrogen peroxide was wasted because activity was confined to a very limited area around the injection point. In addition, aggressive adjustment of groundwater pH with acid was required which is not desirable in a minimally invasive treatment system. Still further, some systems also resulted in the mineralization of the subsurface resulting in undesirable impermeable soil.

The present invention employs the same source of hydroxyl radical (hydrogen peroxide) but seeks a different catalyst that while triggering the production of hydroxyl radicals, does so in a controlled way without the characteristic violent reactions of the prior art.

Ozone was determined to be an exceptional catalyst when used in a catalytically effective amount as the catalyst. Ozone, of course, has been used to generate hydroxyl radicals. This occurs typically by spontaneous decomposition to oxygen where hydroxyl radicals are produced as an intermediate species as disclosed by Nelson/Brown on page 21. In this regard, ozone can react with hydrogen peroxide to produce hydroxyl radicals. However, as indicated in the paragraph bridging pages 6 and 7 of the present application, the amount of hydrogen peroxide and ozone delivered to the in situ environment must be controlled to avoid aggressive reactions at the point of injection and to provide uniform distribution of the hydroxyl radicals. Accordingly, the present invention is premised on employing two steps in the process which are neither taught nor suggested in any of the references of record. In particular, the hydrogen peroxide must be added first to the in situ

environment. The addition of ozone first, as in the prior art, results in spontaneous decomposition and makes it difficult to achieve temporal and spatial control of the oxidation process. Secondly, the amount of ozone is effectively a catalytic amount, enough to trigger the hydrogen peroxide to form hydroxyl radicals. Not so much as to be wasteful resulting in excess ozone spontaneously decomposing.

One must understand that ozone is very expensive. In the present process, the amount of ozone is limited to a catalytic amount effective to convert the hydrogen peroxide to hydroxyl radicals which are the desired oxidative species.

Elgal does not cure the deficiencies of the primary reference because it too uses ozone as the principle reactant, with hydrogen peroxide being added thereafter. As a result, the amount of ozone that is used is not a catalytic amount. The efficiency of the system is therefore compromised. It has been previously shown that Feasey likewise does not cure the deficiencies of the primary reference. Applicant does not dispute that stabilization of hydrogen peroxide solutions was known. But there this no teaching or suggestion in Feasey of the particular process steps that are required in the present invention.

In view of the foregoing, Applicant submits that the present application is in condition for allowance and early passage to issue is therefore deemed proper and is respectfully requested.

It is believed that no fee is due in connection with this matter. However, if any fee is due, it should be charged to Deposit Account No. 23-0510.

Respectfully submitted,


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